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ABSTRACT

In Piaget's dynamic conception of the child's cognitive growth, the transition from sensory-motor intelligence to the developmental stage of representational intelligence occurs during 5 to 7 years of age. The development proceeds from undifferentiation to differentiation, from unintentional to intentional, from unintelligent to intelligent, and includes cognitive processes beyond concrete experience that enables the child to master the ability to think symbolically. The symbolic functions are acquired through specialized development in accommodation and assimilation. The understanding of some of the principal characteristics of the child's cognitive orientation during the first 2 years in school could further success in reading and avoid possible reading failure. During this period, the sensory-motor ancestry still dominates the child's cognitive life with all the attributes postulated by Piaget: concreteness, centration, irreversibility, egocentrism, and transductive reasoning. All these attributes may more or less interfere with the child's learning in general and reading in particular, and may therefore disrupt his developmental process which concerns the totality of his structures of knowledge. References are included. (AW)

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REPRESENTATIONAL INTELLIGENCE AND READING COMPREHENSION:

An Investigation of Piaget's Developmental Aspects of Cognitive Functions as Related to the Reading Process

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Piaget's account of his sequences of cognitive growth commences with the neonate and extends through adolescence. His dynamic conception of cognitive growth can be divided into three major age periods. While the age boundaries are fluid, Piaget contends that the sequences of cognitive growth are inflexible thus following the described pattern from genetic necessity.

Developmental Sequences

The first period is one of sensory-motor intelligence ranging from birth to about 2 years of age. The second period is one of preparation for, and organization of, concrete operations comprising the ages from 2 to 11. The following third period is that of formal operations involving the ages from 11 to 15.

The rather long middle period from 2 to 11 years has been (9) divided

into two subperiods, designated as preoperational representations from 2 to 7 years and concrete operations from 7 to 11 years of age. Toward the end of the preoperational representations period when the child's body is ripe and society requires him to begin the first two formative years in school, that is from about 5½ to 7 years of age, the child's cognitive growth enters into the developmental stage of representational thought or representational intelligence. The development proceeds from undifferentiation to differentiation, from unintentional to intentional, from unintelligent to intelligent (11) and includes cognitive processes beyond concrete experience that enable the child to master the ability to think symbolically.

Symbolic Function

According to Piaget the paramount requirement for representation is the child's ability to differentiate signifiers from significates and thereby to become capable of evoking the one to call forth or refer to the other. The ability to make this act of reference is called symbolic function (7, p. 69; 8). A signifier is a word or an image which symbolizes a perceptually absent event, the significate, of which the signifier is not in some sense a concrete part.

Through the child's possession of symbolic function, representational intelligence differs profoundly from sensory-motor intelligence. The transition of the child's cognitive growth from sensory-motor intelligence into representational intelligence is illustrated in the following table:

The table shows the nature of Sensory-Motor Intelligence and Representational Intelligence as set forth by Piaget. This table has been prepared from and is based on the writing by John H. Flavell in, The Developmental Psychology of Jean Piaget, pages 151 and 152 (3).

Sensory-Motor Intelligence is:	Representational Intelligence through its symbolic capacity has the potential to:
1. capable of linking, one by one, equal to one static frame after another, successive actions or perceptual states;	simultaneously grasp, in a single, internal epitome, a whole sweep of separate events; recall faster and more mobile the past, represent the present, and anticipate the future in one temporally brief, organized act;
2. limited to the pursuit of concrete goals of actions and simply registers empirical success or failure; simply active;	reflect on the organization of its acts as they bear on things; be action-contemplated;
3. limited to the manipulation of concrete acts and objects;	extend its scope beyond actual, concrete acts of the subject and actual, concrete objects in the environment; reach the ultimate in the freedom from concrete reality through symbolic manipulation of entities neither picturable nor tangible;
4. a private event, an individual, nonshared affair; is confined to actions in reality.	representations of reality; become socialized through the medium of a system of codified symbols which the whole culture can share.

The transition into this new cognitive form of representational intelligence enables the child to (1) use symbolic functions, (2) differentiate signifiers from significate, and (3) make references between them. This new cognitive form holds potentialities for the child far beyond captivating limitations of the sensory-motor intelligence.

How do symbolic functions develop within the child just entering school and what are the principal characteristics of that new unfamiliar terrain making up Piaget's account of this complicated and difficult transformation?

Accommodation - Assimilation

Piaget postulated that symbolic functions are acquired through specialized development in accommodation and assimilation. In his book Play, dreams and imitation in childhood Piaget indicates that an accommodation function is imitation or the active, accommodatory replication by the child of some external event serving as model (3, p. 152). However, with growing capacity the child is able to make not only external but also internal imitations. This new internalized ability enables the child to evoke in thought imitations made in the past which, furthermore, enable the child to use them as anticipative outlines for future actions. Piaget contends (7, p. 84) that past accommodations are evoked in the present as internal images which, in turn, are the anticipative mediators of actions not yet performed.

Assimilation, complementing accommodation, supplies the significate to which the signifier refers (7, p. 102). The child now must

provide meaning for his image-signifiers by assimilating them to the schemas or assimilatory structures subtending those events which the signifiers denote.

On the representational plane then, accommodations are therefore two-fold: (1) present or simple accommodations and (2) past or representative imitations or images. The same is true for assimilations: (1) they are present through incorporation of data in adequate schemas and (2) they are past through connections established between these schemas whose meanings are merely evoked, but not provoked by present perception (7, p. 241).

The child now is subjected to a collection of diverse cognitive traits which according to Piaget's own observations are multiple expressions of a single, cognitive orientation. These multiple expressions have principal characteristics which do influence and possibly contribute to or interfere with the child's first successful attempts in learning to read and reading to learn for comprehension. The understanding of some of the principal characteristics and the recognition of these within a child could further success in reading and avoid possible reading failure.

Principal Characteristics

Egocentrism

The first of the principal characteristics is egocentrism. The child's egocentrism is reflected by demonstrating repeatedly an inability not only to see his own viewpoint as one of many others possible but also to coordinate it with these others. He tries

neither to justify his reasoning to others nor to look for possible contradictions in his own logic, nor does he treat his thought processes as an object of thought. In order to do all these things, Piaget firmly believes that interpersonal interactions must emerge in form of disagreement and arguments. Flavell emphasized that social interaction gives the ultimate coup de grace to childish egocentrism (3, p. 157).

Centration

Decentering as a second characteristic of representational intelligence becomes another disruptive trait in the path of the child's cognitive development. It appears that thought has not yet freed itself from perception in order to become "decentered" (1). Piaget repeatedly in 1924, 1950, and 1957 to 1958 expressed his observations of the child's inability to account for features that could balance and compensate for the distorting and biasing effects of the child's single centration (6). In centering the child tends to overemphasize one element and to ignore others.

Action

To understand the development of knowledge means to understand the concept of actions. "To know an object is to act on it," say Piaget (10). At the level of representational thought sensory-motor actions are not immediately translated into operations. But the child is well on his way to know an object, to know an event, as well as to interiorize action which modifies the object of knowledge. Mental replica of concrete actions and events develop into concrete operations

of classification, seriation, construction of the idea of numbers as well as of spacial and temporal operations.

Reversibility

Another characteristic is that of reversibility versus irreversibility. In the totality of the structures of knowledge, the concept of reversibility begins to emerge from the parroting of irreversible events in reality. However, the child, while still struggling with irreversibility, may find himself constantly entangled in contraductions because he is unable to keep premises unaltered during a reasoning sequence. Piaget indicates that there is as yet no conservation which is the psychological criterion of the presence of reversible operations.

Reasoning

In regard to the development of concepts and reasoning, other characteristics, the child does not yet demonstrate his ability to reason in a true sense either inductively or deductively. Instead, he proceeds from particular to particular which Piaget called transductive reasoning. The child, as pointed out by Piaget, tends simply to juxtapose or to reason in syncretic fashion by co-relating a multitude of diverse things within a global schema. Should the child be presented within a given situation or forced into it to find a reason for something, he will do so by relating the situation to something within the syncretic whole.

Equilibrium

Last of some of the principal characteristics concerning the child's transition through the period of representational intelligence, Piaget noted a relative absence of static equilibrium between assimilation and accommodation. Flavell (3, p. 158) indicates that the child is unable to accommodate to the new by assimilating it to the old in a coherent, rational way. Rather, the child is said to be the slave of successive changes that at one time pull him this way and at other times that way. These changes appear to destroy a previously attained assimilation-accommodation equilibrium and therefore his cognitive life tends to be an unstable, discontinuous moment-to moment one. However, with the beginning school age and beyond, the child appears first to struggle to regain equilibrium and when regained, he possesses a rich and integrated assimilatory organization which functions as system-in-equilibrium with a finely tuned, discriminative, accommodatory mechanism.

At the end of the period of representational intelligence in transition to concrete operations, the child's "rigid, static, and irreversible structures begin, in Piaget's phrasing, to 'thaw out' and become more flexible, mobile, and above all decentered and reversible in their operations." (3, p. 163).

Reading Comprehension

Representational intelligence encompasses according to age equivalency the first two formative years in school. During these two years, but particularly during the first one, the child is

expected to learn to read and then to independently read in order to learn. He is expected to learn to associate the 26 conventional symbols of the English alphabet with at least 44 variable sounds, to re-translate them into the given symbols, to recall, to pronounce, and to write them and above all to attach meaning to them in order to arrive at comprehension. To accomplish this complex task in reading, words as signifiers are put into structural arrangements to form phrases, sentences, and paragraphs, which symbolize perceptually absent events (p. 2) or the significates. From the point of representation the child must not only evoke vivid mental images of static, unrelated objects but also the mobility of thought with which to coordinate the relationships among objects in space, time, and logic (2).

This complex reading task is not reserved for an unspecified later time in the reading process but confronts directly any first-grade student when he attempts to read the following two sentences in the story entitled "The Moon Boy" (5): "When they got to the store, Mrs. Lee and Peg went to the third floor, where hats were sold. Bob stayed on the first floor, where toys were sold." To understand this cited passage, the child must be able to assimilate-accommodate-in-equilibrium concepts of space, time, classification, seriation, and number, supported by social knowledge pertaining to this event and through symbolic function imagine the entire situation depicted in this two sentence paragraph.

'Store, first and third floor' require concepts of space because the three people were in the same store but on different floors. Being

in the store indicates that the three people spent a certain amount of time - concept of time - together in the store, then separated to go to two different floors to look at different things. It also denotes that during this interval of time they were in the store, they were absent from home. Classification involves the concept that Mrs. Lee, Peg, and Bob are all members of the same family. Seriation includes the concept that Mrs. Lee is the mother of Peg and Bob, Peg a child and daughter of Mrs. Lee and also the sister of Bob, and Bob a child and son of Mrs. Lee and the brother of Peg. The concept of numerical quantification is evidenced in the recognition that there were three people in the store who separated into two and one. To understand the content of the phrases 'where hats were sold'.....'where toys were sold', the child needs to grasp concepts of intensive or logical quantification. At last, social knowledge is required to understand that a store of this nature has at least three floors, how to get up and down from one floor to the next, what to find on each floor, and how to look at and to obtain things.

Reading comprehension as a mental process is also needed in solving the following arithmetic problem typical of this age group: "John went to the store with 10 cents and bought 8 cents worth of candy. How much did he have left?"

The spacial concept involves the child's realization that John left a place - possibly home - and went from there to the store. The temporal sequence requires the child to imagine that John had 10¢, went from home to the store, bought candy, and then had some money left.

The understanding of the numerical concepts from zero to ten is necessary because the arithmetic problem requires classification to set up an equation of two known whole numbers -10 and 8- and one unknown number to be found. To adequately perform the computational procedure the child's concept of seriation is required in order to arrive at "is equal to" as in 10 - 8 = (is equal to). In addition, the child must bring social knowledge of 'store', 'money value' in form of coins, and 'buying' to the printed page, in order to take additional meaning from the printed arithmetic problem. To depict the entire situation in terms of reading comprehension and arithmetic computation, representation is required from the child to imagine it.

In these two examples the child's representational cognitive actions are more and more internalized rather than externalized as in the sensory-motor period. Gradually, they will cohere to form increasingly integrated systems of actions. Through internalizing actions thought processes originate (4) symbolizing more and more a perceptually absent event.

Conclusion

As the child moves into the first two years of school sensory-motor ancestry is still dominating his cognitive life with all the attributes postulated by Piaget: concreteness, centration, irreversibility, egocentrism, and transductive reasoning. All of those attributes may mildly or severely interfere with the child's learning in general and reading in particular and, therefore, may disrupt his

developmental process which concerns the totality of his structures of knowledge. When, however, his cognitive growth proceeds to the end of the preoperational thought period, representational intelligence gives more and more ground to traits characteristics of concrete operations. Above all, his cognitive life becomes more and more stable. No longer does it operate on a moment-to-moment basis jolting the child from one uncertainty into another, instead, it is marked by adaptation based on the assimilation-accommodation principle with its system-in-equilibrium of which Piaget says (2): "Life is a continuous creation of increasingly complex forms, and a progressive balancing of these forms with the environment."

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